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RESEARCH PAPER

Income Options for the Poorest of the Poor: The Case of Cardamom in Northern Laos

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Abstract This study examines the potential of cardamom for poverty alleviation and sustainable rural development under conditions of increased resource scarcity in the uplands of northern Laos. Drawing on both qualitative and quantitative fieldwork in Luang Namtha province, the supply chain of cardamom is identified and the socio-economic opportunities for collectors and growers are examined. Rising demand in neighbouring countries, particularly China, provide sound income opportunities for all actors in the cardamom supply chain. Growing improved varieties has become a boon for farmers endowed with relatively large land areas with suitable agro-ecological conditions. However, land-poor and landless collectors of wild cardamom are facing increasing difficulties due to overharvesting, lower prices offered by middlemen, and the rapid conversion of remaining forests into monoculture plantations, especially rubber, which has reduced the natural habitat of cardamom and other non-timber forest products. The major policy implication is that protecting the remaining natural and secondary forests—for instance through making use of evolving international support mechanisms for community-based forest protection, including REDD-plus—will not only be of benefit for biodiversity conservation and climate change mitigation, but would also enhance the livelihoods of the poorest groups in the uplands of northern Laos.

Keywords Non-timber forest products · Supply chain · Rural livelihoods · Poverty alleviation

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Introduction

Forests are rich sources of food and income for the upland population of Laos (WFP 2007). Collection and sale of non-timber forest products (NTFPs) accounts for up to 50 % of the annual cash income of upland rural communities in remote areas of northern Laos (Rigg 2004). These are mostly ethnic minorities who depend on subsistence farming as their livelihood base (Seidenberg et al. 2003). NTFPs are particularly important for farmers with low cash incomes who are not specialized in the cultivation of any particular field crop and villagers suffering from seasonal food shortages (Neef et al. 2010). However, the availability of NTFPs is threatened by over-exploitation and increasing deforestation and landscape degradation (ADB 2001; Raintree and Soydara 2001). The National Poverty Eradication Program of Laos aims to achieve its objectives by improving basic infrastructure and by relocating highland populations along roads in the midlands and lowlands (Lestrelin 2010; Neef et al. 2010; Thongmanivong and Fujita 2006). The creation of these new economic zones is often accompanied by large-scale replacement of forestland and traditional swiddens by rubber and teak which have been aggressively promoted by private investors from neighbouring countries and the Lao government (cf. Cohen 2009; Friederichsen and Neef 2010; Neef et al. 2010; Newby et al. 2012). This threatens the livelihood base of many communities that depend on forests as sources for food, medicine, ecological services and incomes. The increasing challenges facing the major actors along NTFP value chains are exemplified in this study by the case of cardamom.

Cardamom (*Amomum* spp.) is one of the world's most expensive spices by weight (Buckingham and Tiep 2003; Tugault-Lafleur and Turner 2009), and is an important component of traditional Chinese medicine (Foppes and Ketphanh 2000). It is collected from forests and cultivated as a domesticated crop, and is the second biggest agroforestry export product of Laos after coffee. The capsules of cardamom contain essential oils, camphor, acetate, limonene and other esters (Kvitvik 2001; NAFRI 2007). Although the local market for cardamom in Laos is negligible, it has been collected for several centuries from native forests and swidden fallows for export, mainly to China and Thailand. The annual demand for cardamom by the Chinese market is estimated to be about 1,500 tons (Aubertin 2004). This demand is increasing and cannot currently be met by collectors and producers of cardamom (NAFRI 2007).

Cardamom is a perennial herb of the Zingiberaceae family, growing throughout Laos in elevations between 500 and 700 m in semi-shaded, moist habitats. The plant can reach a height of 2–3 m (Fig. 1a) and develops a thick rootstock from which the inflorescences grow in pairs of white flowers (Fig. 1b). In the wild, it is a characteristic element of plant communities in the understory of secondary mixed deciduous and evergreen forests. Two kinds of wild cardamom grow in the forests of northern Laos. The wild red cardamom *Amomum microcarpum* C. F. Liang and D. Fang (syn. *A. villosum* Lour.) is locally known as *maak naeng daeng*. Green cardamom *A. ovideum* Pierre is known as *maak naeng khiaw*. The development of cardamom is favoured by a mean annual temperature between 19 and 22 °C and annual rainfall between 1,200 and 2,400 mm. Cardamom depends on the availability

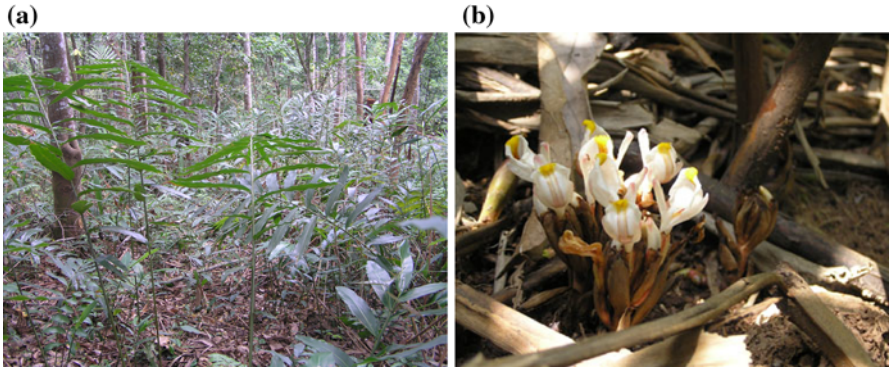

Fig. 1 **a** Cardamom plants in the understory of a secondary forest; **b** Inflorescence

of forestland and is associated with traditional slash-and-burn agricultural practices with long-rotation fallow periods (Aubertin 2004; Liu et al. 2006). In Luang Namtha province, cardamom is mainly marketed as dried capsules (NAFRI 2007), with the first yield occurring 3 years after planting. Weeding is necessary in the first 2 years, before the growth of cardamom starts suppressing weed growth (Zhou 1993; Ducourtieux et al. 2006).

Two cardamom varieties are grown under cultivation. The most widely grown is *maak naeng 'khuang tung'* (*A. xanthoides* Wall.), introduced from China in the mid-1990s and found in all three districts where this study took place (Aubertin 2004; Ducourtieux et al. 2006; NAFRI 2007). The variety *khuang tung* is cultivated on plots at the edges of forests that also contain wild cardamom populations. Another variety, known locally as *maak naeng 'pak song'*, has only been cultivated since 2007. This variety grows in upland fields and does not require 50 % shade like the improved variety *khuang tung* or the local varieties. There is no literature record to date on the cultivation of the *pak song* variety. According to NAFRI (2007), a family is able to harvest on average 108 kg of fresh wild cardamom (corresponding to about 20 kg of dried cardamom) annually, with each family member collecting about 5 kg per day during the very short harvest period of only a few days in July or August.

Since cardamom is produced nearly exclusively for export, and consumers demand high product quality and integrity, an integrated supply chain management from farm to retail outlet is necessary (Wheatley et al. 2004). Hence, the main objectives of this paper are to identify all steps in the existing supply chain of cardamom and its value as an income source and to evaluate whether promotion of this crop can improve the economic situation of rural populations, especially the poorest groups. The next section describes the study area and the research methods for data collection and analysis. The research results are then presented, with a focus on the economic characteristics of collection versus cultivation of cardamom, analysis of the supply chain and distribution of benefits among the various stakeholders. The potential of the cardamom business in northern Laos for alleviating poverty is then examined, and policy implications and avenues for further research are discussed.

Study Area and Research Methodology

Characteristics of the Study Area

The study area is the northern province Luang Namtha, one of the poorest regions in Laos and home to one of the most ethnically diverse populations of Southeast Asia (Fig. 2). At least 11 from the 47 ethnic groups of Laos live in the region and are classified according to their language families into Lao Tai, Mon-Khmer, Chinese-Tibetan and Hmong-Mien. They have long been engaged in swidden cultivation of upland rice and other cash crops including maize, peanuts, cassava, ginger and soybeans. In an attempt to phase out swidden cultivation, the provincial government has actively promoted industrial tree plantations including teak, eucalyptus and rubber for several years.

The location of Luang Namtha favours ground transportation of cardamom to China, a market which absorbs most of the harvested produce. This transport takes place either by road or by boat, the province being partly located along the eastern bank of the Mekong River which forms the natural border of Laos with Myanmar in the west. Fieldwork for this study was conducted from March to May 2008 in 18 villages in three of the five administrative districts of the province: Muang Sing,

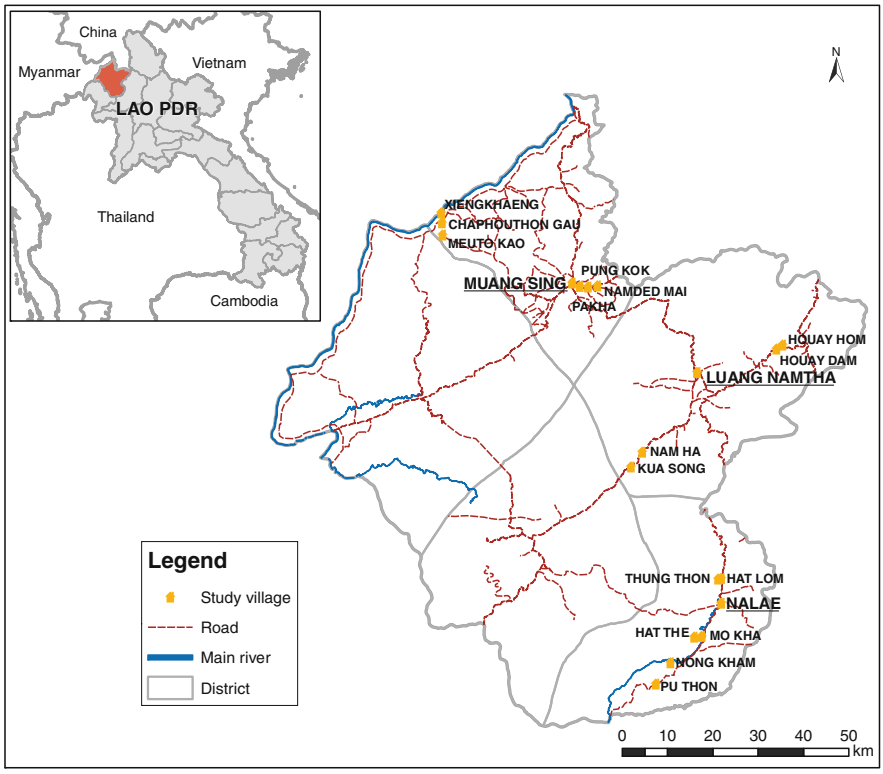

Fig. 2 Map of the research area. *Source* Prepared by Elstner (2009)

Luang Namtha and Nalae. Research sites were selected on the basis of available information at the district offices, from a German-Lao development project and from local informants who knew about the involvement of village communities in the cardamom enterprise. Additional criteria were accessibility of the villages and ethnicity. The Thai Lue (6 villages) are among the politically and economically most dominant ethnic groups in the province, having occupied the more favourite lowland locations with good access to roads and other infrastructure. The Akha (5 villages) are at a lower scale of the ethnic hierarchy and tended to be economically marginalized in the past, but have recently benefitted from their transboundary social networks and increased cross-border economic exchange, e.g. by selling sugarcane and—most recently—rubber to Chinese traders (cf. Sturgeon 2010). The indigenous Khmu (7 villages) are the most marginalized ethnic group in the province and have been most adversely affected by relocation from upland forest areas and the government policy of eradicating swidden cultivation (cf. Friederichsen and Neef 2010; Yokoyama 2010).

Research Methods and Concepts

Qualitative data were collected by means of semi-structured interviews with 36 individual growers, 32 collectors and seven traders of cardamom as well as two representatives of export companies and three government officials involved in various steps of the supply chain. Respondents were selected purposively through chain or snowball sampling. Additional information was sought through focus group discussions after the household surveys. Group discussions were usually composed of 4–8 key informants and encompassed traders, growers and collectors to provide a rich and detailed picture of the various key actors and activities along the value chain. Various interactive methods with visualizing tools, such as cropping calendars and timelines known from Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA), were applied in the group discussions. The sessions were facilitated by research assistants and moderated by the first author who is fluent in the Lao language without being part of the local setting. Session records were analyzed based on the salience of the issues discussed.

Data obtained from qualitative methods were complemented by quantitative data on the incomes and economic status of collectors and growers. The combination of the two types of data generates a broad understanding of the importance of cardamom as a cash crop and as a potentially viable income source for the poor. The supply chain of cardamom was mapped using the value-link methodology described by Springer-Heinze (2007). This allows visualization and description of the flow of cardamom from raw material to the end product. It also illustrates the main processes in place, including business operations (production, packing, domestic trade, export) as well as the operators (producers, collectors, traders, middlemen) and the relationships between them. For statistical analysis, cardamom suppliers, i.e. producers and collectors, were grouped on a cash income basis. To determine the dependence of the groups on the sale of cardamom, a one-way analysis of variance (ANOVA) was conducted using SAS® 9.2. The least significant difference (LSD) was used for pairwise comparison of means, at the 5 % significance level.

Fig. 3 Dried capsules of cardamom

Poverty is used in our study as a relative concept, based primarily on the level of resource endowment and cash income. The subsistence economy in northern Laos is difficult to capture in one-shot interviews since local people do not keep records on yields of staple crops (e.g. upland rice) and their home consumption. The scope of the study also did not allow considering an endogenous or emic perspective on poverty, and we believe that such a perspective may also have entailed differences between the villages, making comparisons across the sample difficult.

Results

Status of the Cardamom Enterprise in Northern Laos

The major share of cardamom produced as a cash crop in the study region is traded as dried capsules (Fig. 3). Marketing of the fresh produce prevents loss of weight per volume which occurs during the drying process. However, the perishable nature of the capsules allows trading of fresh material only in places with good road access. Irrespective of the cardamom variety traded, cardamom is brought to the market by motorbikes, cars, trucks or boat.

Cardamom is usually harvested in the rainy season, when the moist climate makes it difficult for producers and collectors to comply with the quality requirements specified by traders. High quality cardamom capsules should be low in moisture content, clean and intact (NAFRI 2007). Traders check for high quality simply by pressing the fruits with their fingers. Another crude method for assessing the moisture content is placing one arm down a full sack of cardamom capsules. If the trader's hand is dry after removing it from the sack, then the product is dry enough to meet the quality standards. Suppliers were not fully aware of the properties of the crop that need to be preserved during and after harvesting or the quality requirements, because there is little local use[1] of cardamom. The lack of

[1] Only in one village, a cardamom capsule was found in an alcoholic beverage. None of the respondents in the interviews stated that cardamom was used locally. This corresponds with the findings of Yokoyama (2004) in his study of various NTFPs (including cardamom) in Luang Prabang province.

attention paid to quality improvement is in line with the findings of other researchers for the case of cardamom (Aubertin 2004; Ducourtieux et al. 2006) and for other NTFPs (e.g. Neef et al. (2010) for the case of paper mulberry) and may be due to a lack of marketing extension, since NTFPs tend to be neglected by Lao government agencies.

Collection from the Wild Versus Cultivation of Improved Varieties

As indicated in Table 1 some cardamom enterprise activities vary between villages. In most places, people who cultivate cardamom also collect it from the wild.

In the three Khmu study villages of Nalae district, only collection is practised, although people in one of the villages are also involved in the trade of cardamom. In Hat The, a Thai Lue village, a higher share of income is generated by the sale of wild cardamom. In three of the Thai Lue villages people only concentrate on trading cardamom and other NTFPs without being involved in the production or collection of cardamom. These findings reflect the commercial dominance of the Thai Lue people in this province.

Adoption of cultivation of improved varieties is strongly influenced by the availability of suitable plantation sites that provide adequate growing conditions for cardamom, namely moist areas near streams and forest edges. During and after harvesting, capsules of wild and cultivated cardamom are usually mixed together and sold after drying. Only farmers of the *pak song* variety reported they could sell

Table 1 Activities in the cardamom enterprise in the study villages

District	Village	Ethnic group	Collection	Cultivation	Trade
Muang Sing	Namded Mai	Akha	x	x	
	Pakha	Akha		x	
	Pung Kok	Akha		x	
	Chaputon Gau	Akha	x	x	x
	Xiengkhaeng	Thai Lue	x	x	x
	Meuto Kao	Akha	x	x	
Nalae	Thung Thon	Khmu	x		
	Hat Lom	Thai Lue	x	a	
	Hat The	Thai Lue	x	x	
	Mo Kah	Khmu	x		x
	Nalae	Thai Lue			x
	Nong Kham	Thai Lue			x
	Nalae village	Thai Lue			x
	Pu Thon	Khmu	x		
Luang Namtha	Kua Song	Khmu	x	x	
	Nam Ha	Khmu	x	x	
	Houay Dam	Khmu	x	x	
	Houay Hom	Khmu	x	x	x

x: This activity was carried out in this village; a: Cultivation was abandoned due to low productivity

Table 2 Key differences between wild and domesticated cardamom

Feature	Collected from the wild	Cultivated as domesticated crop
Ecology	Collection areas often distant from the village. Access to the collection sites is time-consuming	Plantations are usually nearby or within walking distance to the village
	Wild varieties produce smaller capsules	Improved varieties produce larger capsules, leading to higher yields in smaller plots
	Individual plants distributed over large forest areas	High planting densities generate higher yields
	Dependency on the availability of forest land, which is in decline in Laos	Plantations within production forests
Resource tenure	Undefined tenure rights in collection areas lead to increased competition and premature harvesting	Only the owner of the plot has harvesting rights
Production volumes	Annual fluctuation in harvested amounts	Production volumes are predictable, depending on the season
Market forces	Lower prices paid by traders	Higher prices paid by traders for improved varieties

the capsules in a fresh form. Both wild cardamom and the improved varieties introduced from China are purchased by the same network of traders and middlemen.[2] Farmers who sell unadulterated cultivated cardamom can obtain higher prices compared to those that mix cultivated with wild yields, inducing a shift of farmers' preference towards the improved varieties. In the plantations visited during this study, only improved varieties are currently in cultivation and mostly the *khuang tung* variety. No evidence was found of continuing domestication of wild varieties growing in the local forests.

Both advantages and disadvantages can be observed for the harvesting and trading of wild versus cultivated cardamom (Table 2). Improved varieties growing on plots that are closer to villages have higher yields, and production volumes are more predictable. This allows individual farmers to agree with traders on the amounts to be delivered, by means of contract farming. Cultivation of cardamom is more profitable than collection from the wild and provides exclusive ownership and use rights.

Major Stakeholders Involved in the Cardamom Enterprise

The supply chain of cardamom in northern Laos involves seven groups of stakeholders. Figure 4 depicts the various steps and activities during the product flow from production to processing. The potentials and vulnerabilities encountered in each step of the supply chain are explained in this section.

[2] The use of the term "middlemen" here and throughout the paper is deliberate, since we did not encounter any female market intermediaries for the cardamom trade during our field survey. This contrasts with the study of Walker (1999) who found a strong role of women traders in long-distance commodity trade (cf. Yokoyama 2010).

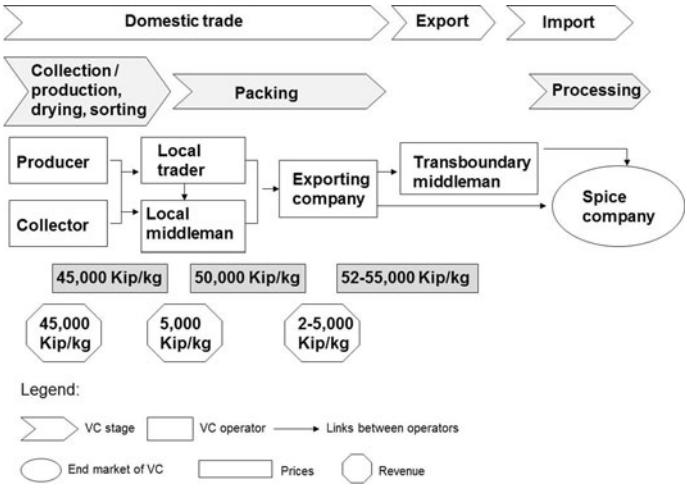

Fig. 4 Sub-sector map of cardamom in northern Lao PDR (prices based on 2007 data). *VC* value chain; kip = Lao local currency. *Source* Adapted from Springer-Heinze (2007)

Sources of Improved Planting Material

Recently, development agencies and non-governmental organizations have distributed seedlings of the improved variety *khuang tung*. However, no nurseries have been established in the target villages to date, except for one near the provincial centre Luang Namtha. Therefore, access to high-quality seedlings is presently not ensured for farmers. Local farmers who are already growing improved cardamom varieties could be sources of seedling stock for farmers wishing to start new plantations for enhancing their incomes.

Collectors of Wild Cardamom

Wild cardamom is collected in forest areas surrounding the villages in an expanse of 15–200 ha. The walk to wild populations can take up to 2 h. Everyone is permitted to collect NTFPs for own use or sale and, in most cases, the entire family goes to the forest to gather wild cardamom in order to ensure a maximum share of the benefits from this increasingly scarce plant. The classification of forests into *protection*, *conservation* and *production* zones is determined by the Forest Law (DOIN 2007), but not always recognized by the rural population. Villagers often classify the collection sites simply as 'forest'. Since property and use rights in the collection areas are not clarified, people from different villages harvest repeatedly at the same known locations. This increases competition over the resource, leading to overharvesting or harvesting of immature capsules that do not meet the desired quality.[3]

[3] Neef et al. (2010) found for the case of naturally occurring paper mulberry in Bokeo province that regulations concerning harvesting rights evolved as a consequence of increasing resource scarcity and competition. However, we could not identify any emerging common property rules for collection of wild cardamom in our study villages.

Producers of Cardamom Cultivars

Producers cultivate cardamom in plots at forest edges with an average size of 0.3 ha per family. These plots are usually located within a walking distance of up to 30 min from the village. Land owners are the only ones allowed to plant, harvest and sell the cardamom.[4] Unlike maize and rice, cardamom is easy to handle, does not need external inputs and requires little labour, as also reported from northern Vietnam (Tugault-Lafleur and Turner 2009). In the case of the *khuang tung* variety which can be cultivated in plots inside the forest, there are additional benefits stemming from the preservation of forest land, namely conservation of biodiversity, and maintenance of soil structure and fertility.

Various problems before and after harvesting were reported by growers. While the plants are not susceptible to insects, yield losses sometimes occur due to rodents feeding on the ripe capsules. Further, because the cultivation areas are not fenced, young plants are in danger of trampling and browsing by cattle and buffaloes which are allowed to graze inside the forest. Losses also occur due to poor post-harvest handling. As cardamom is harvested during the rainy season, where sunny periods are usually short and do not suffice to adequately sun-dry the capsules, it is susceptible to mould. Hence, the fruits are often placed on trays over open fires inside the houses to accelerate drying, which reduces product quality.

For the poorest groups in the communities, i.e. landless and land-poor households, shifting from collection to cultivation of cardamom is constrained by lack of land. Yet even for owners of large land areas the expansion of cardamom cultivation is difficult, mainly due to limited availability of shaded, moist habitats suitable for the establishment of plantations inside the forests. This is exacerbated by the fact that the national government and private investors from neighbouring countries—particularly China—are aggressively promoting rubber plantation monocultures,[5] which are known for inducing widespread deforestation (Cohen 2009; Friederichsen and Neef 2010; Neef et al. 2010). Furthermore, due to high transaction costs linked to poor infrastructure, farmers do not have access to information about demand and prices in the cardamom market.

Local Traders and Middlemen

Local traders live in the villages where collection and/or production occur and, in most cases, they also collect or produce cardamom. They buy dried cardamom from villages in their vicinity, often together with other NTFPs such as incense bark, broom grass, bamboo shoots and the rhizomes of galangal (*Alpinia galanga* Willd.),

[4] Since cardamom is a perennial crop, tenants or landless people are not allowed to grow it, as this could lead to a claim of land ownership rights.

[5] Rubber was first introduced to Luang Namtha province by Hmong refugees from China in Hadyao village in the mid-1990 s (cf. Manivong and Cramb 2008; Cohen 2009). Rapidly growing demand in China in conjunction with the search of Laotian officials for permanent alternatives to swidden farming and opium poppy cultivation has induced a rubber boom since the early 2000s that has dramatically transformed the rural landscapes and reshaped livelihoods of ethnic minority people northern Laos (Thongmanivong et al. 2009; Friederichsen and Neef 2010).

depending on demand and seasonal availability. The produce is then sold to one or more Laotian or Chinese middlemen. Because the harvested cardamom is mainly destined for export to China, Chinese middlemen usually offer higher prices for the purchased amounts.

Middlemen operate in larger villages or district centres. They have better access to infrastructure for transport and trading, either by road or river, in contrast to collectors and producers in villages which are connected only by unsealed roads or roads under construction. In general, middlemen are not involved in collection or in cultivation of cardamom, but buy and sell cardamom together with other NTFPs which follow similar marketing patterns. Cardamom is then sold to exporters or other traders who are based in the district centre Muang Sing or the provincial centre Luang Namtha.

Fees and taxes have to be paid in the various steps of the supply chain, since cardamom is produced only for exports. In most cases, collectors and producers who sell to local traders in their villages do not have to pay any fees or taxes, because the trade is informal, and amounts are generally not registered. Traders who sell cardamom to local middlemen within the same district also escape having to pay fees and taxes. Dues have to be paid only when the produce crosses district and provincial boundaries or the national border. Local middlemen report that for the transport of one ton of cardamom from Nalae to the provincial capital Luang Namtha, a fee of 2,000–3,000 Kip/kg has to be paid to the customs in Nalae. A 5 % general tax, a 10 % income tax and a fixed fee of US$ 1 per ton has to be paid by exporters when the product crosses the national border.

Exporters, Industry and Final Markets

The final actors in the domestic part of the supply chain are local and Chinese export companies, which are based in the provincial centre Luang Namtha. In the last decade, they have marketed various NTFPs—including cardamom, incense bark, orchids, galangal and sugar-palm fruit—to China, Thailand, Vietnam and Korea. These companies have established a network of trading units in various villages in the northern districts, where local middlemen and traders store the cardamom harvest every year. During the harvesting season, sales agents visit the trading units, collect the cardamom and bring it to the companies' headquarters in Luang Namtha, where the produce is collected by transboundary middlemen and then sold to spice companies in various countries.

Transboundary middlemen contact the export companies before the harvesting season to negotiate the desired amounts and fix the price. They receive advance payment of 40 % from the export companies, the balance to be paid upon delivery of the agreed amount. Subsequently, the sales agent of the export companies visit the collection and production villages and offer the price they are willing to pay per kg. Transboundary middlemen and sales agents from the spice companies collect the cardamom from Luang Namtha and transport it across the border into China by truck. This trading structure is well developed and contacts between the various levels of the supply chain are established, although details were not disclosed to the research team. Last in the supply chain are spice companies, but exporters

interviewed in this study did not disclose the amounts traded or the names and locations of the final destination. Exports to Thailand, Korea and Vietnam are also difficult to track.

Evaluation of the Supply Chain

Stakeholders' Perceptions

There are various factors that influence the views on cardamom as a cash crop, as well as the activities of the various stakeholders involved in its supply chain. In general, the involved groups of actors assign positive attributes to cardamom as an enterprise (Table 3). They state that it is an easy crop to handle, without major production and marketing risks and generating profit at all levels of the supply chain.

Market Demand

High demand, which exceeds current supply, is the main driver for adoption of cardamom production. Accordingly, prices have trended upwards in recent years, particularly due to rising demand in the Chinese market (Fig. 5).

Access to Markets and Infrastructure

Since the mid-2000s, local transportation of commodities in Northern Laos has been enhanced by the creation of the Greater Mekong Sub-region's economic corridor, particularly the North–South corridor, linking northern Thailand with Yunnan province in south-western China. As a consequence, the volume and speed of exports of NTFPs has been increasing (Thongmanivong and Fujita 2006). Cardamom prices

Table 3 Evaluation of the cardamom business by the three main stakeholder groups

Feature	Collectors	Producers	Traders
Costs		Low investment costs (ca. 1,000 Kip per seedling). Access to planting material is ensured	
Labour	No need for re-planting. Harvest in the season where labour is available	Low labour demand. No weeding and fertilization needed	Easy handling of the product (acquired from villagers or middlemen)
	The entire family can participate in collection from the wild	Harvesting between rice planting and harvest (labour is abundant)	High value per weight compared to other crops
Inputs	The crop is growing as a natural resource inside protected forests	Plantations expand after initial planting and can be harvested for up to 40 years. No re-planting is required, nor further inputs after initial investment	Acquired from villages together with other crops and NTFPs

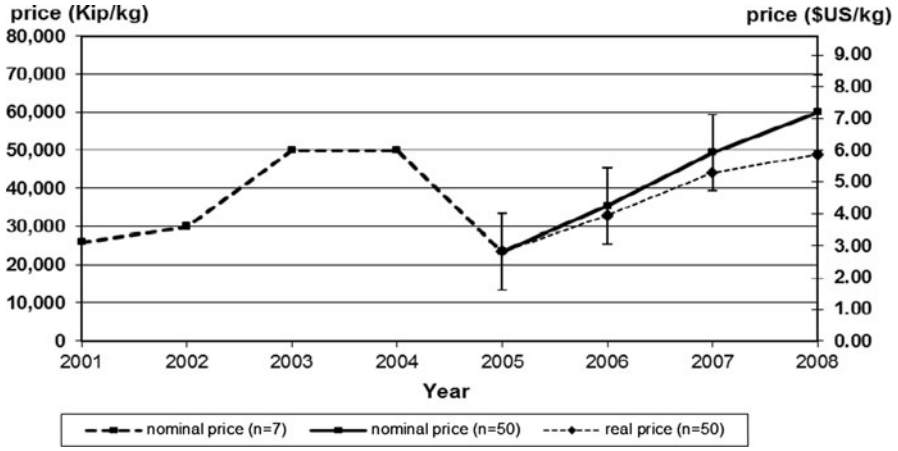

Fig. 5 Trends of farm-gate price development for cardamom from 2001–2008. *Note*: *Dotted line* 2001–2005: $n = 7$, 2005–2008: $n = 50$). Real prices on the basis of 2005 reflect the inflation rate of 2006: 6.81 %; 2007: 4.51 % (Bank of the Lao PDR 2007) and 2008: 8.6 (CIA 2009). Influences due to price fluctuations within the season and price differences between varieties marketed are not considered. Exchange rate: 1 US-$ = 8,719.60 Lao kip; *n* refers to the number of observations

Table 4 Prices paid by traders to producers and collectors of dried cardamom (2008)

Type of supplier	Village	Ethnic group	Price (Kip/kg)	District
Producers	Chaputon Gau	Akha	72,000	Muang Sing
	Pung Kok	Akha	70,000	
	Meuto Kao	Akha	65,000	
	Namded Mai	Akha	60,000	
	Pakha	Akha	60,000	
	Xiengkhaeng	Thai Lue	58,000	
	Nam Ha	Khmu	50,000	Luang Namtha
	Houay Hom	Khmu	40,000	
Collectors	Thung Thon	Khmu	40,000	Nalae
	Hat The	Thai Lue	40,000	
	Hat Lom	Thai Lue	35,000	
	Mo Kah	Khmu	30,000	

are influenced by the location of the collection/production villages and their connection to the national road network. Table 4 presents the prices achieved through sales of dried cardamom in the research villages of the three districts studied.

Marked price differences were observed in the three districts. The highest prices were paid in Muang Sing, which is closest to China, indicating that proximity to the country of export is influencing the price positively. Little cardamom is collected from the wild in this district, and most sales refer to improved cultivated varieties.

The lowest prices for cardamom are offered in the remote Nalae district. Most of the cardamom marketed from this district comes from the wild. It is located farther

away from China, making access by traders more difficult, consequently raising transportation costs. However, new roads are under construction in this district, and the new infrastructure will open more marketing channels to Thailand via Bokeo province. Provided that there is demand in Thailand, as reported by Yokoyama (2010), a new marketing infrastructure could be developed, involving traders other than the ones engaged with exports to China.

Beneficiaries of the Cardamom Enterprise

Contribution of Cardamom to Household Income

Sales of surplus upland rice and major cash crops, livestock and a variety of NTFPs form the income base of the rural communities in northern Laos (Table 5). These sources usually vary between villages but not within villages.

Producers and collectors were divided into quartiles based on their cash income. Analysis of the income quartiles revealed the groups that benefitted most from the sale of cardamom and the percentage of their income earned from it. The highest and lowest quartiles of both groups are indicated in Table 6. Findings suggest that relatively lower incomes correlate with collection of cardamom from the wild.

One-way analysis of variance (ANOVA) determined the dependence of the income groups on direct sales of cardamom. Annual revenues were compared to those generated by the sale of other products, in order to evaluate the percentage contribution of cardamom to the annual income for year 2008 (Fig. 6). The highest share of cardamom in total cash income is found among both producers and collectors of the lower income quartile. No statistical differences could be observed between producers in the high and low income class. High income producers depend to a lower share on cardamom than the high income collectors. Low income collectors obtain a significantly higher percentage of their income from cardamom than the other income classes ($p = 0.05$).

Benefits in Areas Where Cultivation of Cardamom Predominates

To determine the importance of cultivated cardamom for income generation compared to other income sources, two fairly dissimilar villages in terms of wealth were chosen, Pung Kok (Muang Sing district) and Kua Song (Luang Namtha district). The average household cash income and its sources are depicted in Table 7.

Pung Kok ranks the highest in average household income out of the producing villages. In this relatively wealthy village, cash income sources are less diverse and people rely only on the sale of cash crops, including cardamom, as well as the sale of livestock. The highest share of income is generated by the sale of sugarcane, followed by large ruminants (buffalo/cattle) and rice. Cardamom contributes only about 8 % of the total annual cash income.

Kua Song is one of the producing villages with the lowest income. In this village, household income is generated from a wider diversity of sources. Cardamom accounts for about 14 % of the total income, approximately the same as wild broom

Table 5 Cash income sources in villages where cultivation of cardamom and collection from the wild occurs

	Village	Upland rice	Sugarcane	Maize	Pigs	Cattle	Poultry	Other	Galangal	Tree bark	Rattan	Bamboo	Broom grass	Cardamom
Producers	Pung Kok ($n = 10$)	x	x		x	x	x	x						x
	Chaputhon Gau ($n = 1$)	x			x	x				x				x
	Xiangkhaen ($n = 4$)	x			x	x							x	x
	Meuto Kao ($n = 2$)				x		x			x			x	x
	Kua Song ($n = 2$)				x	x	x	x	x	x			x	x
	Nam Ha ($n = 7$)			x		x			x	x	x		x	x
	Houay Dam ($n = 2$)			x	x	x	x	x		x		x	x	x
	Houay Hom ($n = 5$)			x	x	x		x		x		x	x	x
Collectors	Thung Thon ($n = 5$)	x		x	x	x		x		x				x
	Hat Lom ($n = 8$)			x	x	x	x	x		x			x	x
	Hat Teh ($n = 6$)	x		x	x		x	x		x			x	x
	Mo Kah ($n = 8$)	x		x	x		x	x		x			x	x

No data are available for the income generated from rubber, because plantations were still being established at the time of research

x: Provides cash income for most households in the village

Table 6 Highest and lowest cash income quartiles, cash income range and average cash incomes in the research sites (collectors: $n = 32$, producers: $n = 36$)

Type of supplier	Cash income range (in 1,000 Kip/year)	Group average (in 1,000 Kip/year)	Group average (in US-$/year)	
Collectors	High income	6,000–22,000	10,873	1,304
	Low income	<2,000	1,203	144
Producers	High income	15,000–30,000	23,064	2,765
	Low income	<4,000	2,512	301

Exchange rate: 1 US-$ = 8,719.60 Lao kip

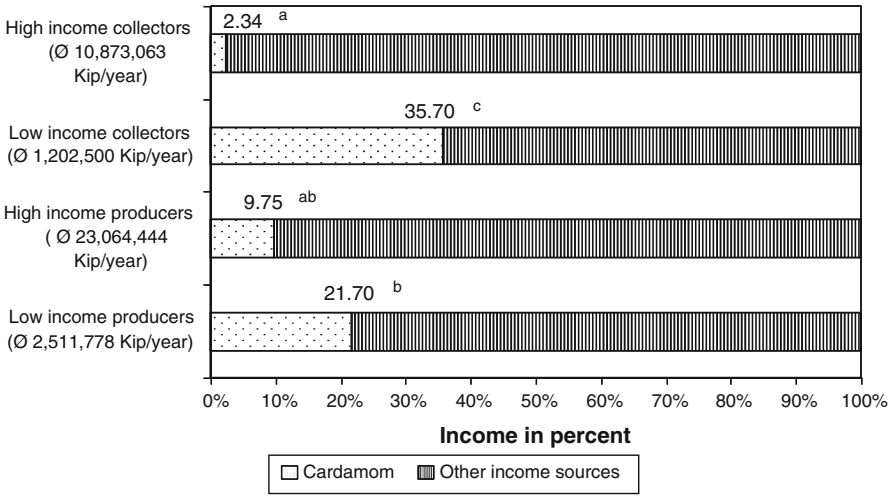

Fig. 6 Share of total cash income (in %) from cardamom sales in 2008 for producers and collectors, distributed over income quartiles (producers: $n = 36$, collectors: $n = 31$). *Note*: *Numbers above the bars* indicate the outcome of the statistical analysis. *Letters* indicate statistical differences, and values followed by the *same letter* are not significantly different at $p = 0.05$; Ø = average for this group

grass, while tree bark and galangal together contribute about 8 %. Hence, the collection and sale of NTFPs contributes more than one third of the annual income, with the remainder generated by the sale of livestock including pigs and large ruminants. While the relative share of income generated by cardamom in Pung Kok is lower than in Kua Song, in absolute terms it is more than three times as high.

Benefits in Areas Where Cardamom is Mainly Collected from the Wild

Income sources and distribution in villages where cardamom is collected from the wild, mainly located in Nalae district (Table 8), differ substantially from the cardamom-cultivating villages. Hat Lom is one of the richest villages where collection from the wild occurs. Sales of cardamom collected in this village contribute less than 1 % to overall income, compared to other income sources including raising buffaloes and cattle, maize cultivation and raising pigs which together contribute

Table 7 Share of cardamom in the annual household cash income for 2008 in two villages that cultivate the crop

Type of commodity	Pung Kok (Akha; $n = 10$) average household income		Kua Song (Khmu; $n = 6$) average household income	
	in 1,000 Kip	in %	in 1,000 Kip	in %
Upland rice	4,120	13.6	0	0.0
Sugarcane	13,637	44.9	0	0.0
Pig	1,967	6.5	643	12.9
Buffalo/cattle	7,800	25.7	625	12.5
Poultry	120	0.4	367	7.3
Galangal	0	0.0	313	6.3
Tree bark	0	0.0	100	2.0
Broom grass	0	0.0	683	13.7
Cardamom	2,462	8.1	697	14.0
Others	258	0.8	1,560	31.3
Total	30,364	100.0	4,988	100.0

Table 8 Share of cardamom in annual household cash income for 2008 in two villages that collect cardamom from the wild

Type of commodity	Hat Lom (Thai Lue; $n = 8$) average household income		Mo Kah (Khmu; $n = 8$) average household income	
	in 1,000 Kip	in %	in 1,000 Kip	in %
Upland rice	0	0.0	638	11.3
Maize	3,957	29.2	294	5.2
Pig	2,000	14.8	700	12.5
Buffalo/cattle	5,220	38.5	0	0.0
Poultry	600	4.4	200	3.6
Tree bark	169	1.2	213	3.8
Broom grass	50	0.4	85	1.5
Cardamom	86	0.6	491	8.7
Others	1,475	10.9	3,000	53.4
Total	13,557	100.0	5,621	100.0

more than 80 % of the annual income. Former failure of cardamom production, promoted between 2000 and 2003, discouraged villagers from continued growing of cardamom. As a consequence, plantations have been replaced by rubber monocultures. Respondents reported that they will not plant cardamom again and would rather invest in what they believe are more promising crops, notably rubber.

Mo Kah, by contrast, ranks among the poorest villages where collection of cardamom occurs. In this village, household incomes stem predominantly from sales of pigs and rice, while cardamom accounts for about 9 %, more than 10 times as high as the share in Hat Lom.

In summary, Tables 7 and 8 suggest that poorer households and communities tend to rely more on the cardamom business for sustaining their livelihoods than the more affluent ones.

Conclusions and Policy Implications

Potential of the Cardamom Enterprise

Cardamom presents an interesting case with potential to enhance rural livelihoods and promote sustainable land use in upland areas of northern Laos. It delivers high annual yields and is an important income supplement for rural households. Moreover, cardamom production enhances the temporal diversification of income generation, since harvesting occurs before that of rice and maize, thus balancing the labour requirements for rural families. Existing market channels are well-developed and—coupled with continuing improvements in transportation infrastructure—can open up new opportunities through trade for exports.

Cultivation of cardamom can be an option for rural people with land rights and an overall financial ability to bear the necessary investment costs, namely for seedlings and labour. Traditionally, collection from the wild has been a more viable option for the poorer parts of the rural populations that do not have access to land and capital. Yet with the on-going depletion of wild cardamom populations as a consequence of the expansion of rubber and teak plantations, this opportunity is rapidly diminishing. Shifting from collection to cultivation of cardamom could be a solution that delivers incomes when collection from the wild becomes impossible. In doing so, farmers need to consider their land endowment and the labour capacity of their families, as well as the fact that different varieties of cardamom have different agro-ecological requirements.

Policy Implications

Present tenure policy interferes with the life-cycle and the ecology of wild cardamom (Aubertin 2004). The central government allocates three land parcels per family for rainfed or dry rice, resulting in shorter fallow periods. This policy conflicts with the traditional rotation spanning over 15 years and leaving land in every stage of succession. This practice favoured spontaneous growth of wild cardamom, which normally requires at least 5 or 6 years for reaching moderate populations in fallows (Yokoyama 2004; Neef et al. 2010). Moreover, many forests with wild cardamom populations are conservation zones which limit collection of NTFPs. Therefore, current allocation policies and forest zoning, coupled with interferences with the lifecycle of cardamom induce a decline of its agro-ecosystems. This puts at stake the potential for generating additional incomes for collectors, who are usually the poorest groups in the study area.

Vigorous promotion of rubber monocultures leads to large scale deforestation and habitat loss. Inevitably, this results in degradation of wild plant resources that

are important for own use and commercial purposes. As this resource depletes further, the possibility to collect and sell cardamom—contributing up to a fifth of the total cash income in some communities in Nalae district—will also decrease. Continuation of this trend puts at stake an important base for the livelihoods of communities, especially in isolated mountain areas.

Conservation policies that protect forestland and biodiversity in the long term are imperative for maintaining the few remaining secondary mountain forests which provide moist and shaded habitats for the growth of cardamom. This is particularly relevant for watershed forests at higher elevations which conserve water resources amongst other ecological services. Laos is one of the countries that could benefit most from emerging REDD-plus projects and other payment schemes towards conserving its remaining forest cover and needs to develop an appropriate legal and policy framework that is more inclusive of small-scale, community-based forestry models (cf. Neef and Thomas 2009; see also Dargusch et al. 2010). Integration of such policies with rural development strategies will also help the central government to fulfil its commitments towards multi-lateral environmental agreements for mainstreaming biodiversity considerations into sectoral policy plans (MAF 2010).

Suggestions for Further Research

The present study provides an elementary assessment of the domestic part of the supply chain of cardamom in northern Laos. Further research is required in order to identify which steps of the supply chain offer the largest potential for increasing economic efficiency. There is a need for accurate data on the amounts of cardamom traded in the market and in-depth comparative economic studies that will estimate the exact margin gained by cardamom and other crops. This assessment must include all steps of the value chain from supply of quality planting material and establishment of nurseries to harvesting, transport and processing.

Research on appropriate drying facilities that can be communally organized is needed for improving post-harvest handling and product quality. Monitoring the drying facilities and estimating the necessary monetary and labour inputs are also essential. The acute focus on cultivation of imported improved varieties has an apparent impact on the population genetics of wild cardamom. These effects should be considered and studied with a view to improving the resilience of the crop system, as local varieties are gradually neglected. Participation of rural communities in research forms the basis for the development of value chains of more plant products that may follow the supply-demand patterns of cardamom in the future.

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